Planning for Computing

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- **Planning for multi-year hardware needs**
  - **Establish a model based on D0 experiment's usage of current computing**
  - **Establish best use of contributions from FNAL and other institutions**
- **Since 2002, DO has been developing a set of spreadsheets used for making cost projections and calculating value.**
- **Typically use data rate and total number of events collected as underlying quantity.**
- **Use past year experience to predict hardware futures**
- **Infrastructure usually budgeted on a replacement cycle, except for networking, which has a component that scales with nodes and fileservers**
- **Spreadsheets give some indication of how the assumptions influence the outcome**

- **Use two different concepts**
  - **Cost – assess the best way to spend budget to cover yearly needs**
  - **Value—an estimator of what computing is worth based on the parameters of performing a task**

Reconstruction Costs Example

Year		2005	2006	2007	2008
Average Rate		16	30	30	30
efficiency		80%	80%	80%	70%
contingency		20%	20%	20%	20%
Reco time		55	80	80	80
Required CPU		628320	1713600	1713600	1958400
Existing system		344947	436170	1248642	1219671
Nodes to purchase		92	293	75	85
Node Cost		$202,147	$644,279	$165,787	$186,248
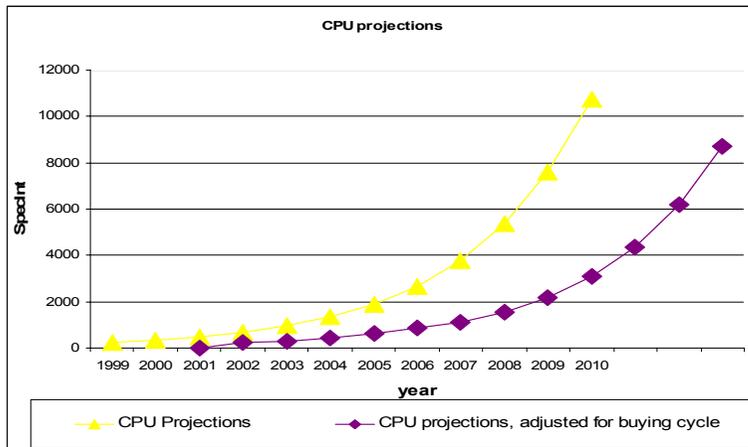
CPU projections

The number of nodes needed to do reconstruction depends on many assumptions.

CPU speed projections are shown-adjusted for buying cycle in one year. Probably not a valid long term estimate. Shown as an indication of the pitfalls

Yearly Costs

data samples (events)

	Current	2005	2006	2007	2008
events collected	1.00E+09	5.05E+08	9.46E+08	9.46E+08	9.46E+08
total events		1.50E+09	2.45E+09	3.40E+09	4.34E+09

TAPE data accumulation (TB)

	Current	2005	2006	2007	2008
Yearly storage (TB)	757	525	697	763	830
total storage (TB)	757	1,282	1,979	2,742	3,572

disk data accumulation (TB)

	Current	2005	2006	2007	2008
Yearly storage (TB)	45	51	96	96	96
adjusted for format change in 2005	0	43	0	0	0
Yearly adjusted storage (TB)	45	95	96	96	96
total storage (TB)	45	140	236	332	428

	Purchased 2003	Purchased 2004	Purchase 2005	Purchase 2006	Purchase 2007	Purchase 2008
FNAL Analysis CPU	$470,000	$277,000	$417,132	$534,926	$406,376	$350,311
FNAL Reconstruction	$200,000	$370,000	$454,269	$717,742	$443,490	$362,546
File Servers/disk	$111,000	$350,000	$357,000	$356,000	$293,000	$276,000
Mass Storage	$280,000	$254,700	$40,000	$600,000	$300,000	$100,000
Infrastructure	$244,000	$140,000	$547,000	$200,000	$200,000	$200,000
FNAL Total	$1,305,000	$1,391,700	$1,815,402	$2,408,667	$1,642,867	$1,288,856

Virtual Center Accounting

- **For the value basis, determine the cost of the full computing system at FNAL costs, purchased in the yearly currency**
    - **Disk and servers and CPU for FNAL analysis**
    - **Production activities such as MC generation, processing and reprocessing.**
    - **Mass storage, cache machines and drives to support extensive data export**
- **Assign fractional value for remote contributions**
    - **Merit based assignment of value**
    - **Assigning equipment purchase cost as value ("Babar Model") doesn't take into account life cycle of equipment nor system efficiency or use.**
- **Not included as part of the value estimate yet**
    - **Wide Area Networking**
    - **Infrastructure (difficult to assign value to legacy components)**
    - **desktop computing**
    - **remote analysis**

		Estimated Value			
		2005	**2006**	**2007**	**2008**
FNAL Analysis CPU		$724,054	$833,811	$817,048	$738,631
FNAL Reconstruction		$820,089	$1,087,730	$773,295	$543,752
File Servers/disk		$560,000	$688,000	$528,000	$560,000
Mass Storage		$1,182,000	$1,201,000	$1,501,000	$1,501,000
FNAL Infrastructure		$0	$0	$0	$0
MC		$128,353	$170,152	$160,390	$85,056
Reprocessing		$1,792,632	$3,317,845	$3,245,506	$2,940,120
Virtual Center Total		$5,207,128	$7,298,539	$7,025,239	$6,368,560